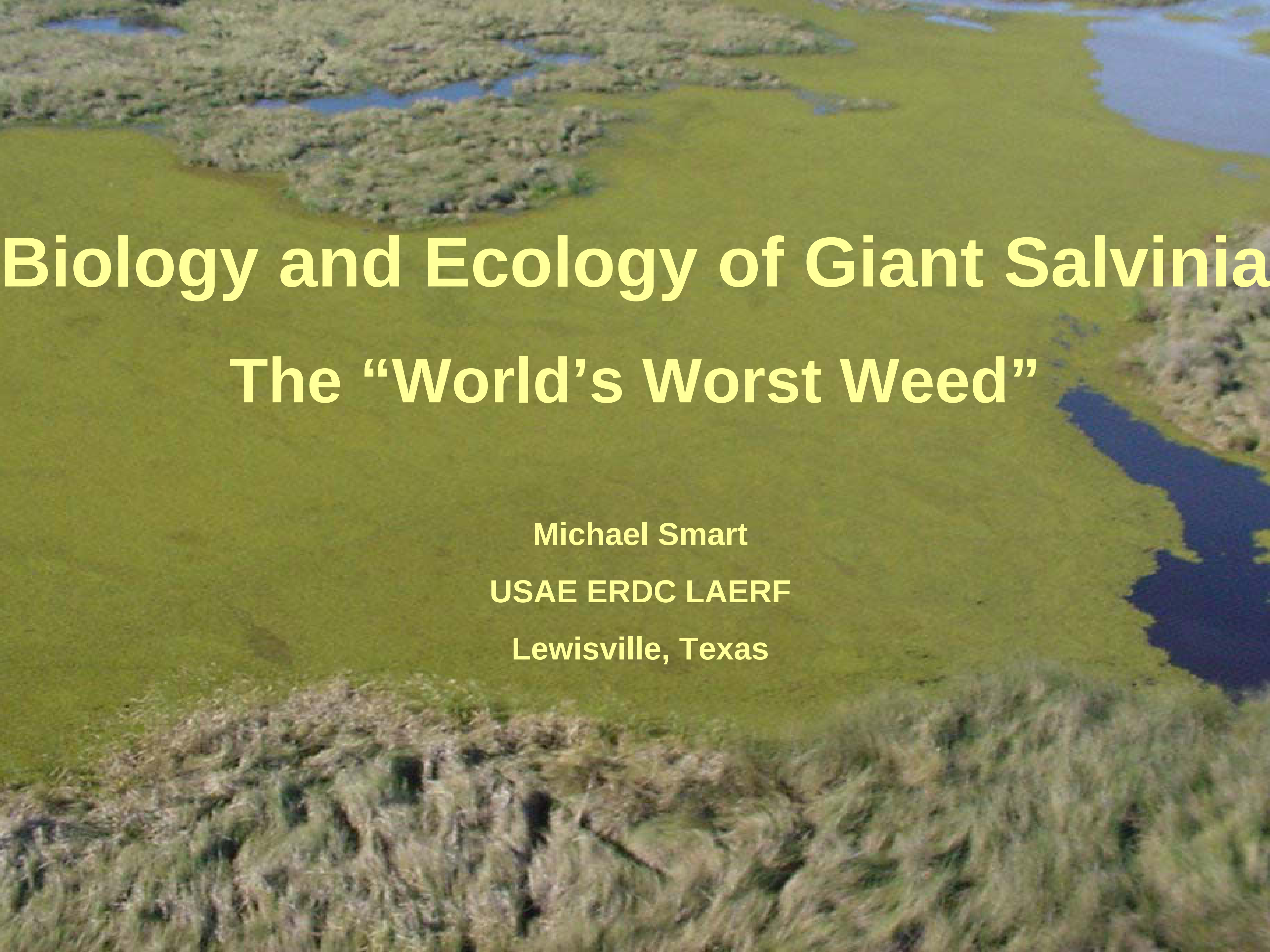


Biology and Ecology of Giant Salvinia

The “World’s Worst Weed”

Michael Smart

USAE ERDC LAERF

Lewisville, Texas

An Ecological Approach
to Management of Invasive Aquatic Plants

Michael Smart

US Army Engineer Research and Development Center

Lewisville Aquatic Ecosystem Research Facility

Lewisville, Texas

Funded by: Aquatic Plant Control Research Program

Aquatic Plant Management Society

Special Session on Giant Salvinia

rs. David Mitchell and
lic Julien visit from
ustralia and share
heir experiences with
.S. researchers

Everything you need to know about Giant Salvinia

"It's bad."

"It's here."

"Gotta kill it!"

Why do we (Corps of Engineers) have so many aquatic weed problems?

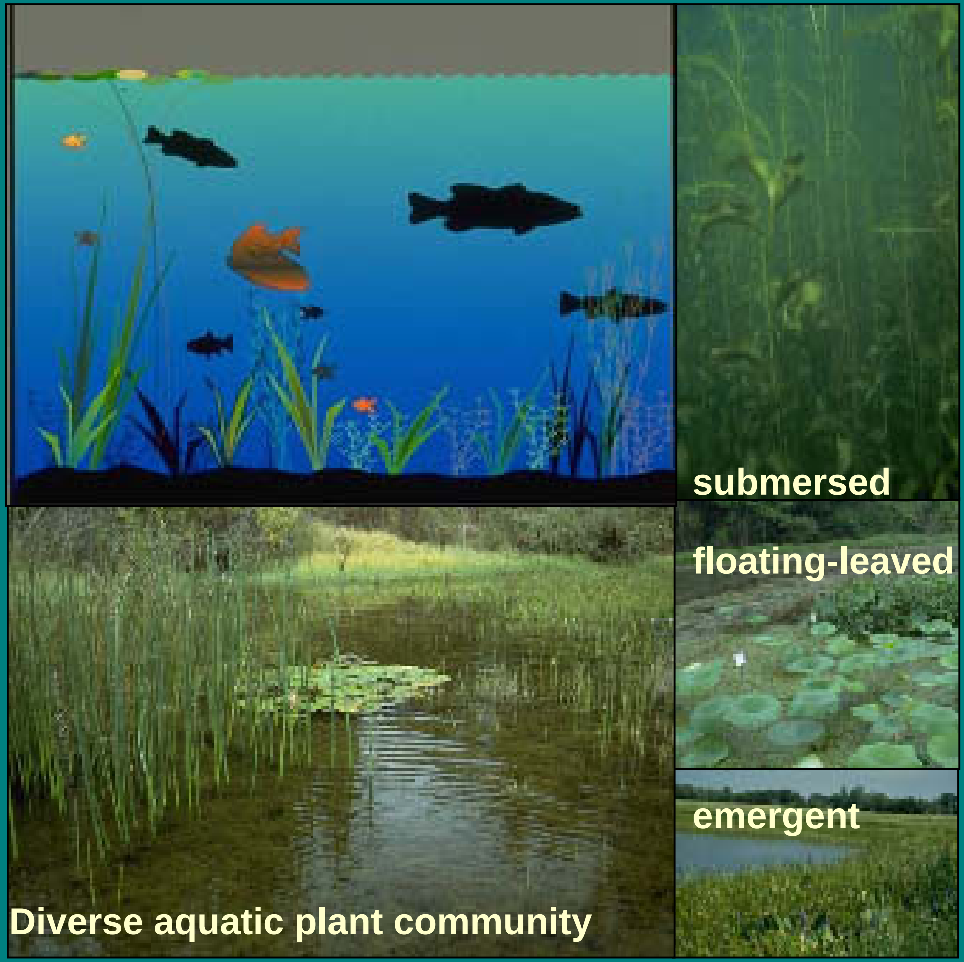
Hydrilla growing in 10 –12 feet of water in Guntersville Reservoir, Alabama

Engineers build dams, not reservoir ecosystems

Flooded terrestrial systems - do not come equipped with aquatic plant propagules

Natural Lakes

The diverse aquatic plant communities of natural lakes have developed over hundreds or even thousands of years



Man-made Reservoirs, Waterways

ne age of our reservoirs measured in decades.

ecologically young

Unvegetated systems invite colonization

Man-made systems often lack aquatic vegetation

Natural systems hav often been so disturbed that they systems have lost their vegetation

Disturbance

an event that creates an empty niche or resets the community to an earlier successional state

Disturbed systems ar colonized by pioneer ruderal species

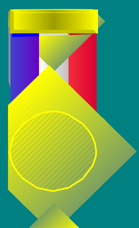
Characteristics of ruderal species

- Rapid growth rates
- Broad tolerance ranges
- Early maturation and reproduction (fragmentation)
- Adapted for dispersal (fragmentation)

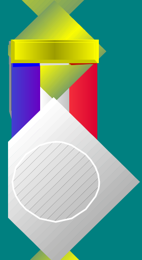
We do have ruderal species that are native to the U.S. but …

- Nonindigenous species often outnumber native pioneer species in the landscape
- Nonindigenous species often arrive first, pre-empting the resource
- Nonindigenous, invasive aquatic plants are *disturbance specialists*, in fact several of these are the *best adapted weeds in the world!*

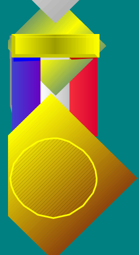
“world-class” weeds



Giant salvinia
(Salvinia molesta) — **Brazil**



Waterhyacinth
(Eichhornia crassipes) — **South America**



Hydrilla
(Hydrilla verticillata) — **Southeast Asia**

Eurasian watermilfoil
(Myriophyllum spicatum) — **Europe/Asia**

Once they arrive,

ney often go
ndetected for some
me and then …

they exhibit explosive growth, rapidly filling available niches.

Management actions that empty the niche promote weedy species

When we “manage” these weedy species …

- The remaining plants, freed from competition with their neighbors, exhibit greatly increased rates of growth and often recover very rapidly

- If we are very diligent we may succeed in …

“Successful” elimination of waterhyacinth?

A key to successful management of nonindigenous aquatic plants is …

never leave an empty niche!

The best defense (against nonindigenous invasive aquatic plants) is a good offense!

Plant native aquatic plants to deter invasive species and provide water quality, habitat, and sediment stabilization benefits

Giant salvinia (*Salvinia molesta*) free-floating aquatic fern

- Origin: southeastern Brazil
- Source: 1990s - water gardening and/or aquarium trade
- US distribution: (predicted range approximates the current distribution of water hyacinth)
- Controls: chemical, biological, drawdown, grass carp

Life Cycle of Giant Salvinia

- **Sterile pentaploid**
  - No sexual reproduction
  - If spores produced they are nonviable
- **Vegetative reproduction**
  - Any leaf pair can regrow a new colony
  - Tiny buds as small as 1/8th” are capable of growing into a new plant

Growth forms and morphology

“Survival” form

Growth forms and morphology

“Colonizing” form

Growth forms and morphology

"Mat" form

Growth Requirements

Potential Limiting Factors?

Growth requirements: Light

- Free-floating plants are the “canopy” species
- Generally have an abundance of light
- Tolerates shade

Growth requirements: Temperature

- Maximum growth at around 30 C (86 F)
- Freezing kills it

Growth requirements: Nutrition

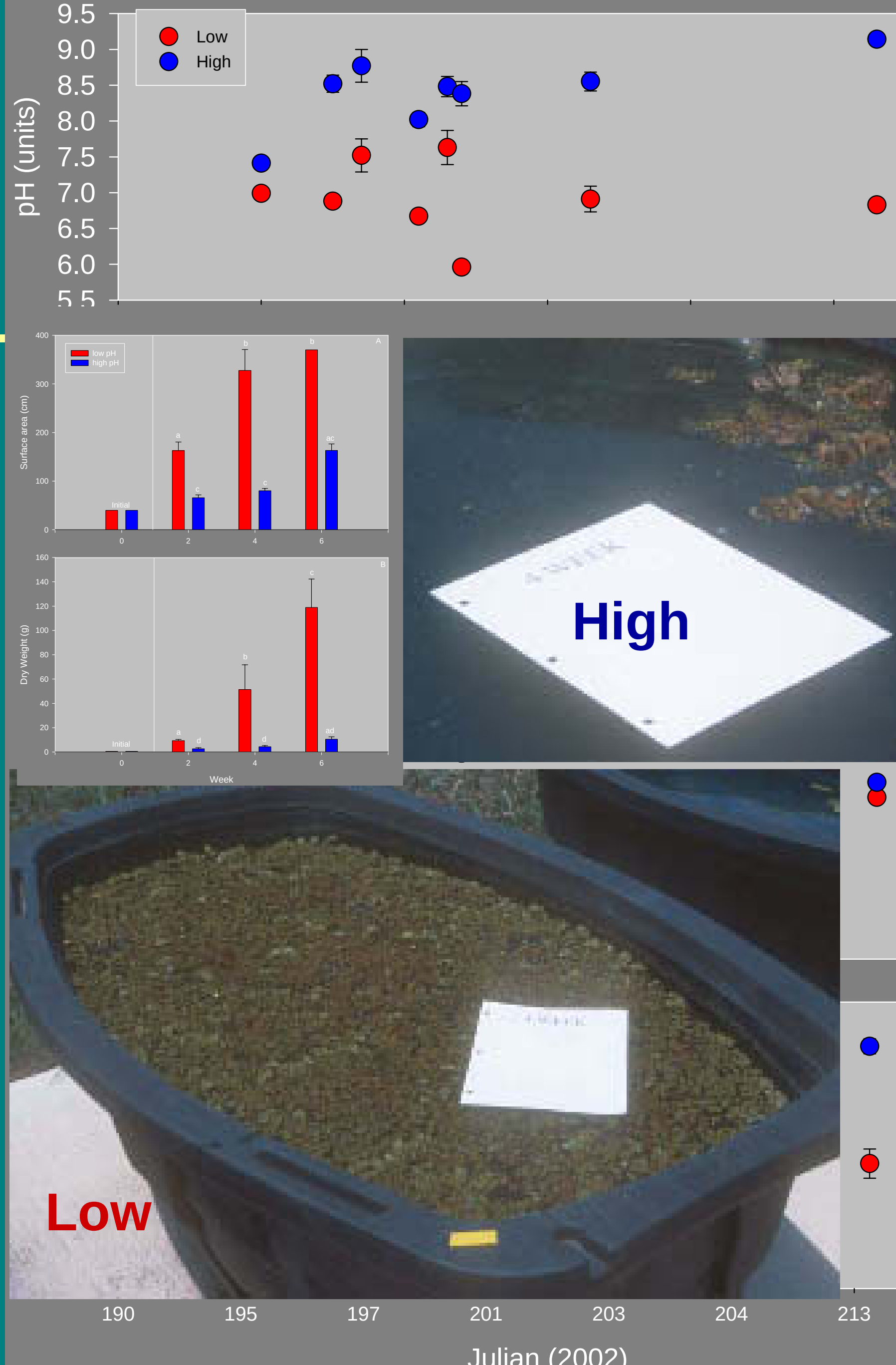
- Free-floating plants are dependent on the water for their nutrients
- Nitrogen, Phosphorus, Iron are likely limiting factors

Growth requirements: Nutrition

- Rapid growth during early colonization is facilitated at pH levels of 6 to 7 (iron limitation) and high concentrations of N and P

Effects of pH on Early Growth

Tank Study (4 weeks)



Effects of pH on growth of Giant Salvinia

"Typical" pond

Acidified pond

Growth requirements: Nutrition

- The “mat” form plants can recycle their own nutrients
- The mat causes changes in the water chemistry that promote nutrient release from the sediments

Growth requirements: Salinity

- Does not tolerate salinity >10% seawater

Ecological/Environmental Effects of Giant Salvinia

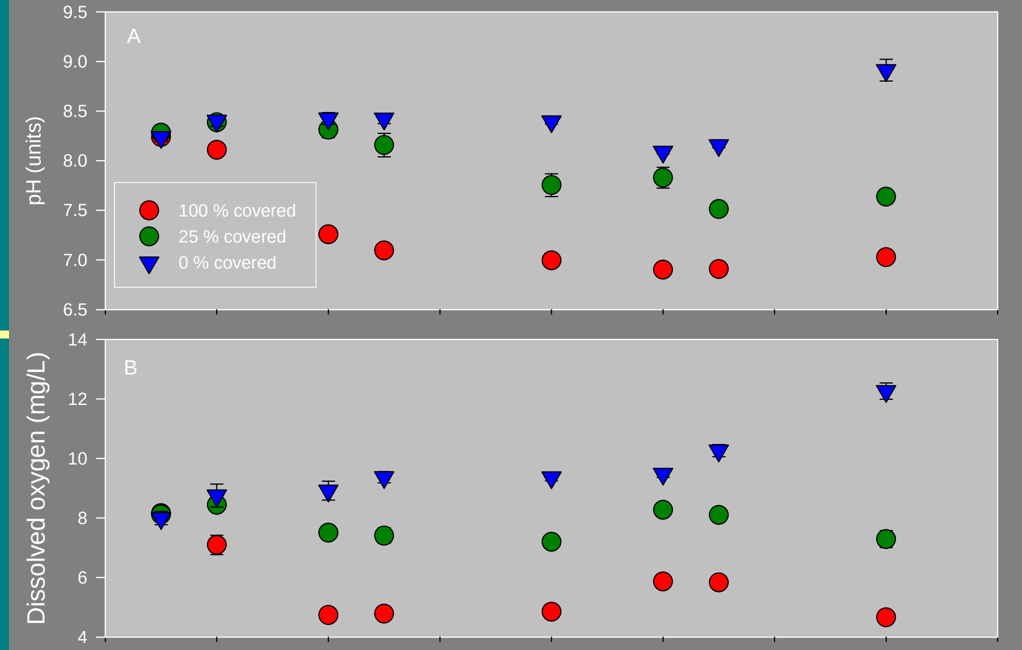
Surface mat:

- Blocks light
- Prevents mixing
- Impedes gas exchange
- Lowers pH

Effects of Salvinia growth on water chemistry

ank Study:

%, 25%, 100% cover

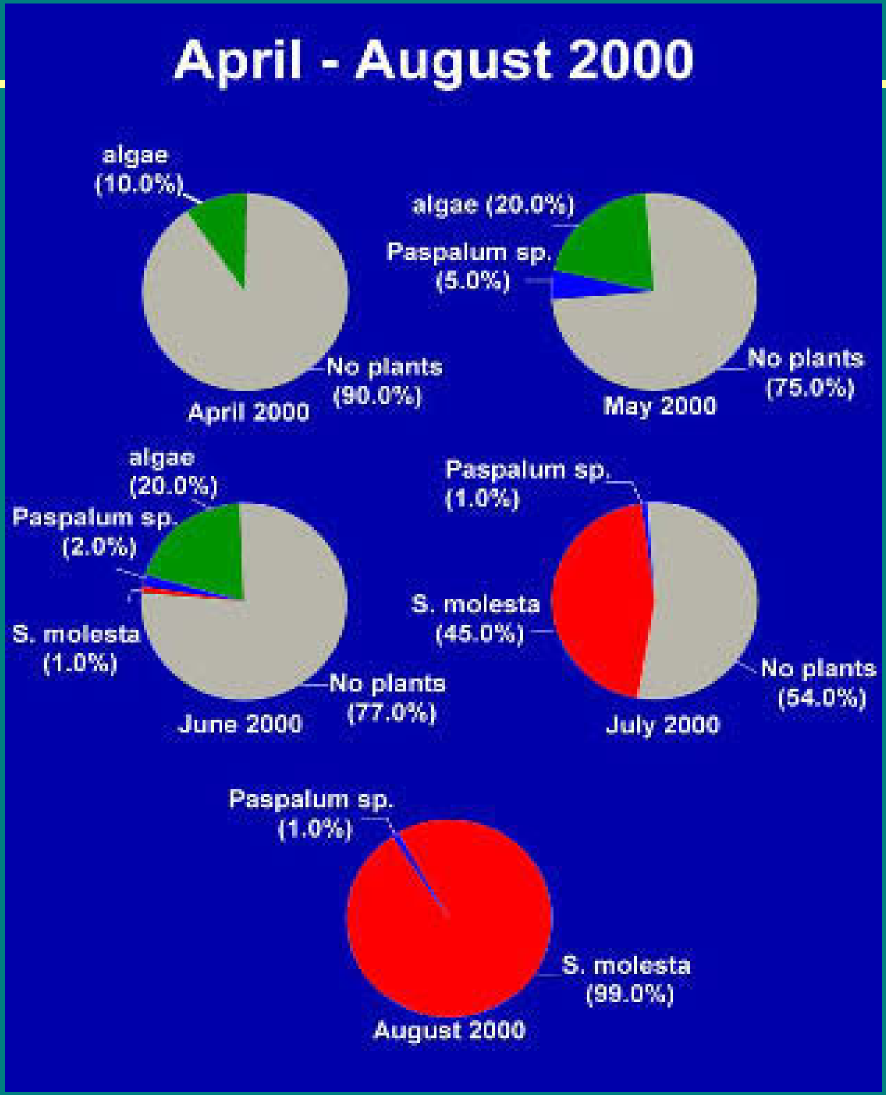


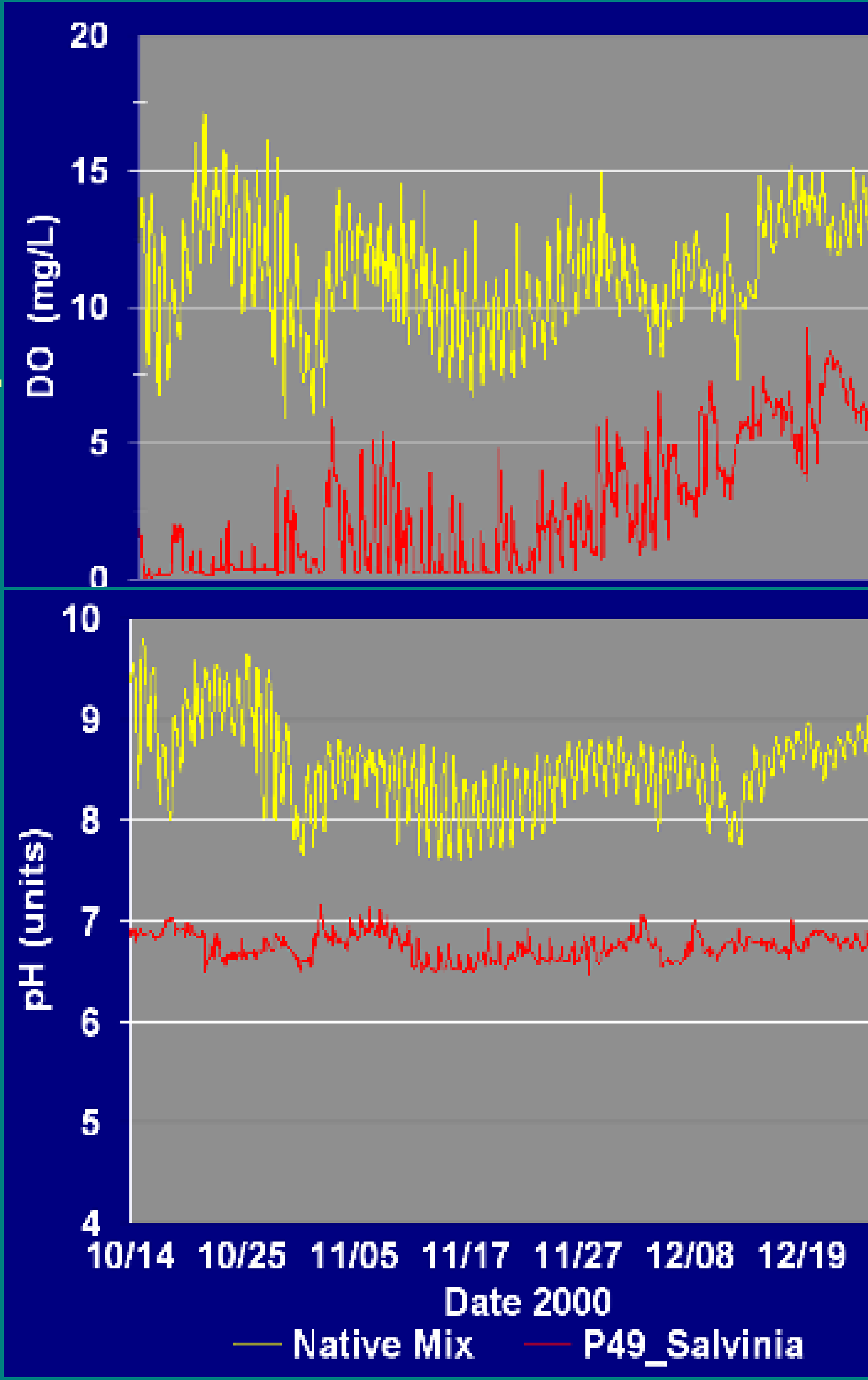
Ecological/Environmental Effects of Giant Salvinia: Pond Study

ixed Native Plant Community

Giant Salvinia Pon

Ecological/Environmental Effects of Giant Salvinia





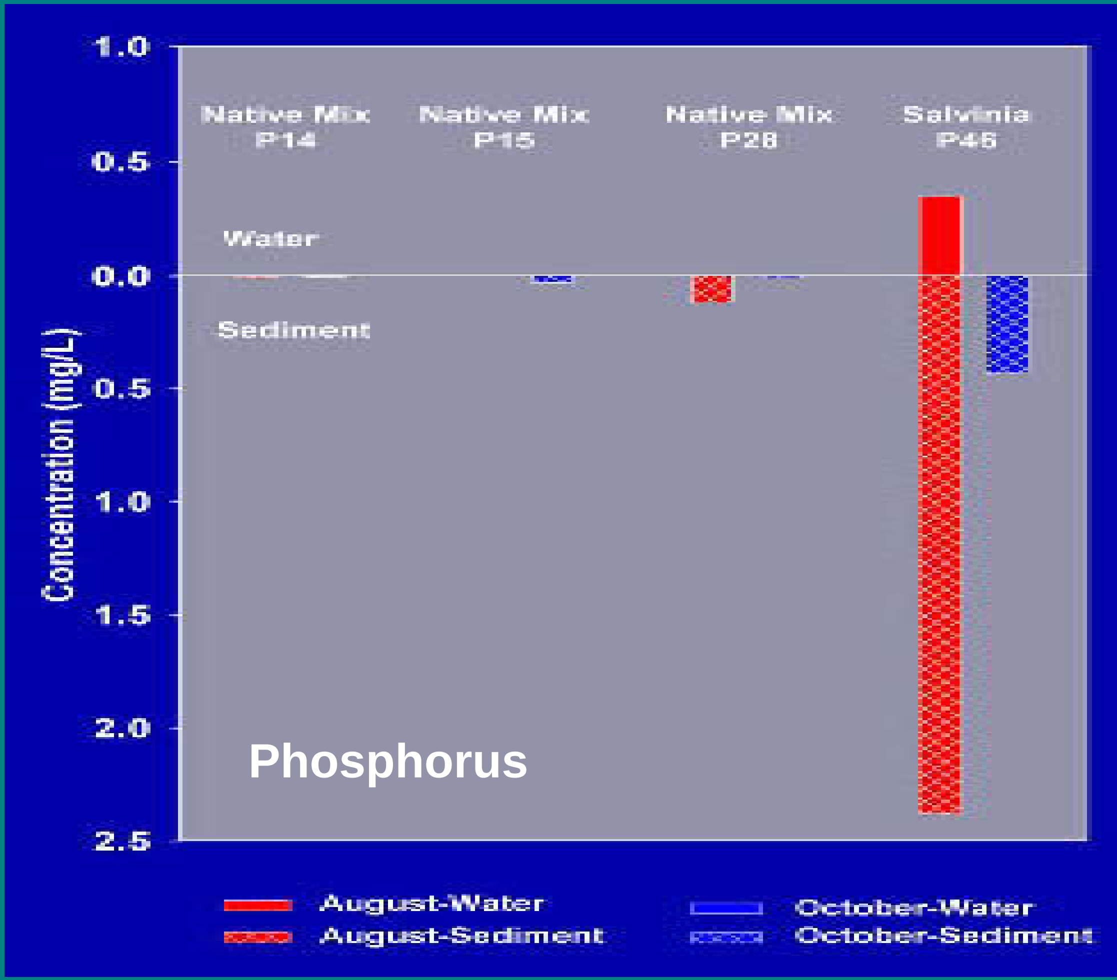
Ecological/Environmental Effects of Giant Salvinia

biogenic nutrient pump

naerobiosis in the Giant alvinia pond causes edimentary iron oxyhydroxides be reduced and solubilized.

hosphorus adsorbed onto the on oxyhydroxides is olubilized.

he native plant ponds contain ery low concentrations of utrients.

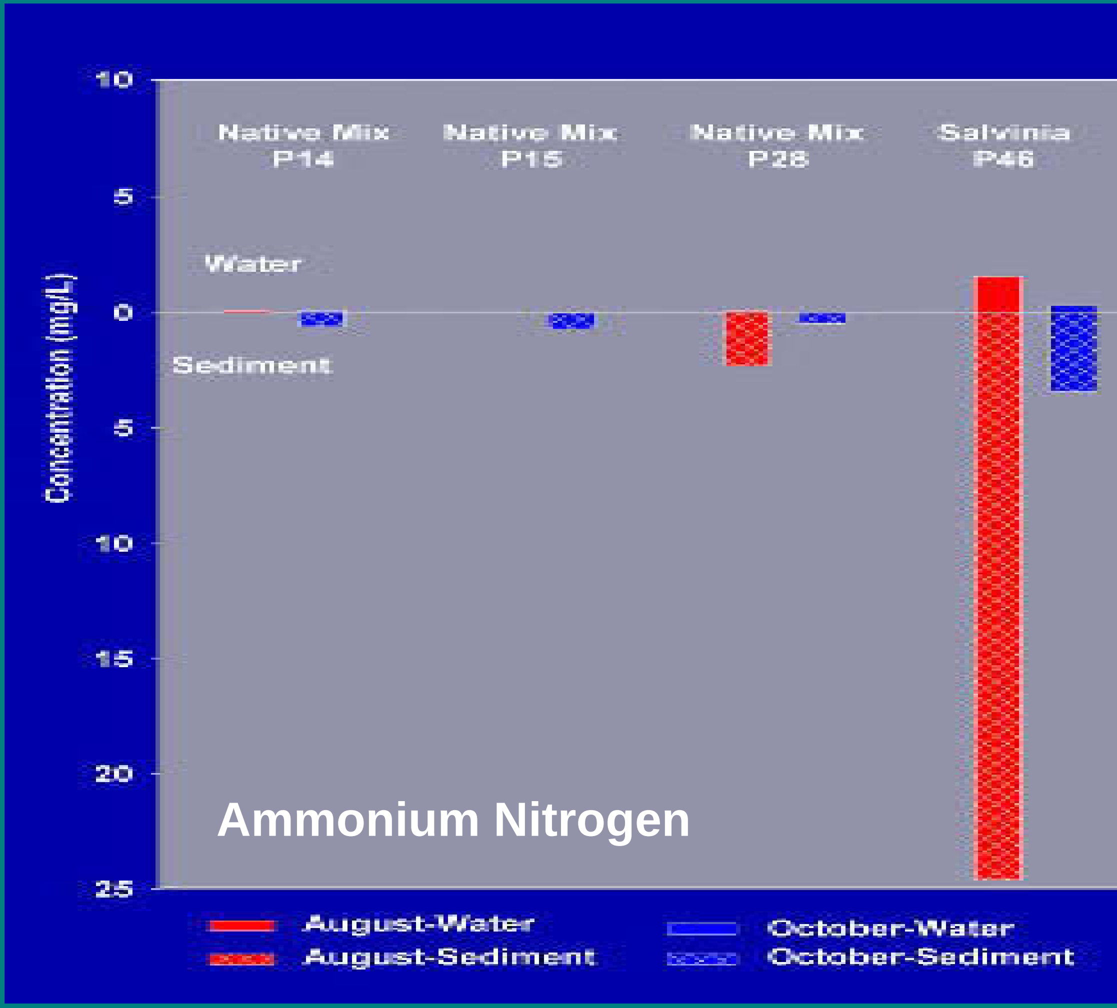


Ecological/Environmental Effects of Giant Salvinia

biogenic nutrient pump

naerobiosis in the Giant alvinia pond causes an crease in sedimentary mmonium nitrogen.

ne native plant ponds contain ery low concentrations of utrients.



Conclusions

- **Look for Giant Salvinia in low pH, unvegetated, nutrient-rich, fresh waters**
- **Once it gets established it is persistent**
  - Slower growth rates
  - Recycles nutrients
  - Sets up biogenic nutrient pump
- **Giant Salvinia has the potential to devastate freshwater habitats**

Everything you need to know about Giant Salvinia

"It's bad."

"It's here."

"Gotta kill it!"